SDW 25

Scientific Detector Workshop
Canberra 6-10 October 2025

Detector nerds gather down under
To discuss and celebrate technical wonder
As wide field surveys come to the fore
Euclid, Rubin, Roman, and more
Photon counters are the newest toys
APDs and Skippers eliminate noise

- James Beletic, Teledyne

Australian National University Research School of Astronomy & Astrophysics
DZA Deutsches Zentrum Astrophysik
Canberra Convention Bureau
Leonardo
Teledyne Technologies Everywhereyoulook

Sunday 5 October	
06:00 - 9:00PM	Registration and Welcome Reception Canapes, drinks and free time to explore: Gallery 1 – Zap! Clank! Pow! Gallery 2 – Fundamentals Gallery 3 – Awesome Earth (includes Earthquake House) Gallery 7 – ExciteQ2 (includes Free Fall) Venue: Questacon, King Edward Terrace, Parkes

Monday 6 October	
Venue: Research School of Physics Auditorium, 160 Mills Road, Acton Conference Wifi: Username: SDW2025 Guest Password:D3t3ct0r	
8:15 AM	*Registration including Welcome to Country*
8:45 AM	*Morning Announcements & Australian Word(s) for the Day*
9:00 AM	*Invited Talk - Aaron Roodman (VRO) The Vera Rubin Observatory Camera*
9:30 AM	*Naidu Bezawada* *"Operational aspects and performance overview of the ELT MICADO H4RG detectors"*
9:50 AM	*James Beletic* *"An Overview of the Types of Photon Counting Detectors"*
10:10 AM	*Markus Loose* *"Operational Techniques for Improving Performance of HxRG-Type Detectors"*
10:30 AM	**Coffee Break - Auditorium Foyer**
11:00 AM	*Andrew Bradford* *"State of the art of SW APDs"*
11:20 AM	*Robyn Sharman* *"Evaluating Linear Mode Avalanche Photodiode Arrays for Photon Counting Applications"*
11:40 AM	*Shotaro Tada* *"Development of an InGaAs infrared detector for the JASMINE mission"*
12:00 PM	**Lunch Break - Auditorium Foyer**
01:15 PM	*Australian flora/fauna snippet*

01:30 PM	*Invited Talk - Mark Clampin (NASA) - NASA Space Missions update*
02:00 PM	**Poster session** *Brock Parker - "Developing Skipper CCDs with enhanced UV QE"* *Javier Reyes - "Wireless solution for monitoring liquid nitroge"* *Jorge Jimenez - "Thermal Stress Evaluation for Hybridisation Testing of 2k×2k IR FPAs"* *Joseph Tufts - "ULTRASAT detector mosaic"* *Bo Shojaei - "Teledyne's detector and readout integrated circuit (ROIC) technologies"* *Cristobal Padilla - "Cryogenic Optical System for VLWIR Detector Characterisation"* *Bernard Chaudoir - "ORION sensor 10um 66Mpixel high dynamic range and sub-electron dark noise image sensor"* *Shane Jacobson - "Peripheral wavefront sensors at Gemini"* *Brian Taylor - "Cleaning of CCDs. We present the results of a non invasive method for cleaning of a CCD"* *Julian Cuevas-Zepeda - "Machine learning-based technique for automated sensor calibration"* *Miqueas Gamero - "Characterisation of a MAS-CCD for astronomical observations"* *Eduardo Medinaceli - "Euclid's detector array"* *Guillaume Huber -"Latest characterisation results of 1kx1k LmAPDs for ultra low noise NIR astronomy"* *Mark Downing - "MAVIS, Multi-Conjugate Adaptive Optics Assisted Visible Imager and Spectrograph"* *Martin Roth - "Lab test and commissioning results for qCMOS camera at Calar Alto"*
02:40 PM	*Gregory Bredthauer* *"Custom CCD controllers by STA"*
03:00 PM	**Coffee Break - Auditorium Foyer**
03:30 PM	*Annino Vaccarella* *"The Rosella controller system"*
03:50 PM	*Rosario Cosentino* *"SPAD camera prototype development"*
04:10 PM	*Mathias Richerzhagen* *"ESO's next generation detector controller"*
04:30 PM	*Kensho Tanaka* *"NINJA, the LTAO-optimised IR spectrograph for SUBARU"*
04:50 PM	*Jason Griesbach* *"Innovations for the amateur astronomer market"*
05:10 PM	*End of Day*

Tuesday 7 October	
8:30 AM	*Arrival. Morning tea and coffee*
8:45 AM	*Morning Announcements & Australian Word(s) for the Day*
9:00 AM	*Invited Talk - Denis Marchais (Airbus)*
9:30 AM	*Matthew Hicks* *"Leonardo Space and Astronomy Portfolio"*
9:50 AM	*Muthu Jeganathan* *"Teledyne's Geosnap 10-micron pitch, 4Kx4K, LWIR Detector Array Characterisation"*
10:10 AM	*Martin Roth* *"DZA German Center for Astrophysics: CMOS development plans"*
10:30 AM	**Coffee Break - Auditorium Foyer**
11:00 AM	*Michael Bottom & Guillaume Huber* *"Overview of the University of Hawaii's program to develop a large-format APD"*
11:20 AM	*Gert Finger* *"APD for Extreme adaptive optics"*
11:40 AM	*Takehiko Wada* *"Development of IR-SOIPIX, a monolithic Si-BIB mid-infrared imaging sensor"*
12:00 PM	**Lunch Break - Auditorium Foyer**
01:15 PM	*Australian flora/fauna snippet*
01:30 PM	*Invited Talk - Rob Green (JPL)*
02:00 PM	*Peter Orel* *"Development and characterisation of single photon wide-field imagers for future telescopes from X-rays to optical"*
02:20 PM	*Dileep Reddy* *"Superconducting nanowire single-photon detectors (SNSPD)"*
02:40 PM	*Showcase/ Tour*
03:00 PM	**Coffee Break - Auditorium Foyer**
03:30 PM	*Showcase/ Tour*
03:50 PM	*Showcase/ Tour*

04:10 PM	*Showcase/ Tour*
04:30 PM	*Bus departs 160 Mills Road, Acton for Mt Stromlo Observatory*
05:00 PM	*Tour Stromlo*
06:00 PM	*Brian Schmidt Lecture, Mt Stromlo Visitor Centre*
07:00 PM	**Golden Roast Dinner & Stargazing with Dr Brad Tucker** **Venue: Commonwealth Solar Observatory Common Room** **Mount Stromlo Observatory**
09:15PM	*Bus departs Stromlo back to 160 Mills Road, Acton arrives 9.45pm*
Wednesday 8 October	
8:30 AM	*Arrival. Morning tea and coffee*
8:45 AM	*Morning Announcements & Australian Word(s) for the Day*
9:00 AM	*Invited Talk - Kentaro Motohara (NAOJ)*
9:30 AM	*Julian Cuevas-Zepeda* *"A Preliminary Evaluation on the n-SiSeRO CCD"*
9:50 AM	*Nicolas Baier* *"PSF sampling with the EBIC probe"*
10:10 AM	*Marco Bonati* *"MAS skipper CCD performance on the CTIO0.9m telescope"*
10:30 AM	**Coffee Break - Auditorium Foyer**
11:00 AM	*Fernando Pedichini* *"DATT: The Detector Advanced Test Track"*
11:20 AM	*Kenneth Lin* *"Optimisation the MAS CCD readout"*
11:40 AM	*Brenda Cervantes-Vergara* *"p-channel skipper-CCDs"*
12:00 PM	**Lunch Break - Auditorium Foyer**
01:15 PM	*Australian flora/fauna snippet*
01:30 PM	*Invited Talk - Luc Boucher (ESA)*

02:00 PM	*Erika Hamden* *"UV optimisation on Skipper CCDs"*
02:20 PM	*Guillermo Moroni* *"MAS-CCD development at Fermi Lab"*
02:40 PM	*Agustin Lapi* *"MAS-CCD readout optimisation"*
03:00 PM	**Coffee Break - Auditorium Foyer**
03:30 PM	*Brandon Roach* *"Development of p-channel skipper CCDs for astronomy"*
03:50 PM	*Theodore Grosson* *"SPAD array to observe the visible PSF of the REVOLT AO testbench"*
04:10 PM	*Christopher Montalban* *"First on sky application of MAS Skipper CCDs for astronomical imaging"*
04:30 PM	*Blas Irigoyen-Gimenez* *"Enhancing the signal-to-noise ratio (SNR) of Skipper CCDs for astronomical applications"*
04:50 PM	*Claudio Chavez* *"Results of the Skipper-CMOS sensor developed by Fermilab and Tower Jazz"*
05:10 PM	*End of Day*
06:00 PM	*Bus departs 160 Mills Road to Australian National Museum. If walking, depart 5.30Pm*
06:10 PM	**Conference Cocktail Evening** **Venue: Australian National Museum** **Lawson Cres, Acton** **(Option to walk - approx ~21mins)**
09:00 PM	*Bus departs museum back to 160 Mills Road, Acton. Or walk back.*
Thursday 9 October	
8:30 AM	*Arrival. Morning tea and coffee*
8:45 AM	*Morning Announcements & Australian Word(s) for the Day*
9:00 AM	*Invited Talk - Roger Smith (Caltech)*
9:30 AM	*Manoj Sri-Vatchavai* *"The GaiaNIR mission"*
9:50 AM	*Sukwon Youn* *"Space radiation detectors for lunar surface radiation environment"*
10:10 AM	*Clara Bataillon* *"Infrared spectroscopic instrument for the ARIEL mission"*

10:30 AM	**Coffee Break - Auditorium Foyer**
11:00 AM	*Ralf Kohley* *"Pixels with purpose: science and wonder in Euclid's Colourful Universe"*
11:20 AM	*Herve Geoffray* *"CNES recent developments for infrared space missions: Status and prospects"*
11:40 AM	*Eloy Hernandez* *"Development of the IBEX detector at ESA"*
12:00 PM	**Lunch Break - Auditorium Foyer**
01:15 PM	*Australian flora/fauna snippet*
01:30 PM	*Invited Talk - Matthew Soman (ESA)*
02:00 PM	*Nathan Saffold* *"Demonstrating skipper-CCD operation in space with DarkNESS"*
02:20 PM	*Oswald Siegmund* *"Microchannel plate detector schemes for UV photon counting imaging detectors for NASA and ESA"*
02:40 PM	*Eduardo Medinaceli* *"Euclid's detector array"*
03:00 PM	**Coffee Break - Auditorium Foyer**
03:30 PM	*Stephane De Miguel* *"Detection chains evolutions for space missions at Thales Alenia Space"*
03:50 PM	*Panel discussion* *CCD vs CMOS and Curved Detectors: Key Issues Revisited* *Chair Naidu Bezawada* *Panelists: Luc Boucher, Olaf Iwert (remote), Markus Loose, Shouleh Nikzad, Aaron Roodman, Roger Smith*
04:50 PM	*Yassine Faris* *"LSST camera commissioning"*
05:10 PM	*Kosuke Kushibiki* *"ULTIMATE-Subaru is a next-generation near-infrared instrumentation project for the Subaru Telescope"*
05:30 PM	*End of Day*

06:00 PM	*Bus departs 160 Mills Road for Australian National Arboretum*
06:15 PM	**Conference Gala Dinner** **Venue: National Arboretum** **Forest Drive, off Tuggeranong Parkway, Molonglo Valley**
10:15 PM	*Bus departs Arboretum 10.15pm back to 160 Mills Road*
Friday 10 October	
8:30 AM	*Arrival. Morning tea and coffee*
8:45 AM	*Morning Announcements & Australian Word(s) for the Day*
9:00 AM	*Invited Talk - Shouleh Nikzad (NASA)*
9:30 AM	*Gustavo Rahmer* *"Status of the first-generation science instruments for the Giant Magellan Telescope"*
9:50 AM	*Javier Valenzuela* *"Mitigating anomalies in astronomical images at Paranal"*
10:10 AM	*Jian Wang* *"WFST Primary mosaic CCD camera and its first light"*
10:30 AM	**Coffee Break - Auditorium Foyer**
11:00 AM	*Tony Travouillon* *"The Wide-Field Spectroscopic Telescope"*
11:20 AM	*Branden Allen:* *"Large Detector Planes for Next Generation Observatories"*
11:40 AM	*Naidu Bezawada* *"Status of the current and future detectors and detector system needs at ESO "*
12:00 PM	**Lunch Break - Auditorium Foyer**
01:15 PM	*Australian flora/fauna snippet*
01:30 PM	*Discussions and concluding remarks*

ABSTRACTs

Presenter: Dr. Aaron Roadman
Affiliation: Vera Rubin Observatory, USA
Invited talk title: The Vera Rubin Observatory Camera

Abstract

N/A

Presenter: Dr. Naidu Bezawada
Affiliation: European Southern Observatory (ESO), Germany
Title: Operational aspects and performance overview of the ELT MICADO H4RG detectors

Abstract

MICADO, the Multi-Conjugated AO Imaging Camera for Deep Observations, is one of the first-light instruments for the ELT and is currently in manufacture by a consortium in Europe, lead by the Max Planck Institute for Extraterrestrial Physics (MPE), Garching. As one of the partners of this consortium, the European Southern Observatory (ESO) is responsible for delivering the near infrared detector system for MICADO.

This detector system comprises 9xH4RG-15, 2.5um cutoff detectors, in a closely butted 3x3 mosaic focal plane and will use ESO's new general detector controllers (NGCII) configured for control and readout of the detectors in various modes. The procurement of these H4RG-15 near infrared detectors for both MICADO and HARMONI (High Angular Resolution Monolithic Optical and Near Infrared Spectrograph) is currently in progress and the detectors, as they are received, are being characterised in a custom-built test facility at ESO. Out of a total of 17xH4RG-15 detectors, the characterisation of the first 9 detectors is expected to be completed by the end of the year.

This paper presents some of the specific operational modes and their effects on the performance of the detectors, some commonly observed features such as the cross hatch pattern and its effect on the performance with operating temperature, the output buffer glow and its elimination in the latest detectors with an upgraded readout integrated chip (Rev. B ROIC), the workaround for the stability issues that some detectors suffer from and the behaviour and the effect of high contact resistance in some pixels and seen on some detectors, at different operating temperatures. The paper also provides an overview of the performance metrics including the persistence characteristics of these first 9 H4RG detectors at both 85K and 40K

Presenter: Dr. James W. Beletic
Affiliation: Teledyne Digital Imaging, USA
Title: An Overview of the Types of Photon Counting Detectors

Abstract

This presentation reviews the technologies for three approaches for photon counting in the UV, visible, and Infrared wavelengths: superconductors, semiconductor-based, and photoemissive. The technologies and status of the following detectors will be presented: MKIDs, SNSPDs, TES, Skipper CCDs, Skipper-in-CMOS, HgCdTe electron Avalanche Photodiodes (e-APDs), and micro-channel-based detectors.

Presenter: Dr. Markus Loose
Affiliation: Markury Scientific, USA
Title: Operational Techniques for Improving Performance of HxRG-Type Detectors

Abstract

Operational Techniques for Improving Performance of HxRG-Type Detectors: Several space and ground-based instruments currently under development are exploring new concepts of operation to improve various performance aspects of the long-established HxRG detector arrays. The presentation will discuss these ideas, show possible implementations, and, where available, present test data showing improvements in signal-to-noise, frame rate, and combined science & guiding.

Presenter: Dr. Andrew Bradford

Affiliation: Leonardo, UK

Title: Developments in Leonardo UK high performance shortwave APDs for astronomy applications

Abstract

Linear-mode, avalanche photodiode arrays (LmAPD) based on bandgap-engineered HgCdTe, grown by Metal Organic Vapour Phase Epitaxy (MOVPE) are an important product type in Leonardo UK's portfolio of Infrared detector products.

LmAPDs are advantageous in high-value space and astronomy instruments where the photon count is low, and conventional detectors cease to be sensitive. There are three main categories of application area for LmAPDs. Firstly, for applications with fast frame rates and intrinsically short integration time, such as wavefront sensors, fringe trackers and devices for rapid-time-domain astronomy. LmAPDs arrays for these applications are established in 320x256 and 515x512 formats, with an avalanche gain of >100x at 15V bias and 80-100K operating temperature. Secondly, for free-space telecoms, LIDAR and gated arrays a GHz version of the LmAPD is available. Thirdly, there is a class of applications with very low photon arrival rates, and these provide the most demanding of challenges for LmAPDs. The main application field for these low flux detectors is astronomical imaging and interferometry.

In a collaboration with the University of Hawaii (UH) a 1kx1k/15µm device for low flux applications has been developed including a low dark current version of the LmAPD. After detailed characterisation at UH, results show dark currents below 0.001ph/s/pixel and usable avalanche gain up to 10x. A further 2kx2k development of this device is planned. In addition, further development of the diode structure is ongoing to reduce tunnelling currents with the aim of achieving single photon counting. This paper provides an update on the technology used to manufacture these devices and the status of these developments and collaborations. Updates on the latest test and characterisation results will be presented.

Presenter: Ms. Robyn Sharman
Affiliation: Science and Technology Facilities Council (STFC), UK
Title: Evaluating Linear Mode Avalanche Photodiode Arrays for Photon Counting Applications

Abstract

UKATC is working with Cambridge University, Leonardo UK, and UCL on a de-risking activity for the GaiaNIR mission. This activity aims to demonstrate the feasibility of using Leonardo UK's LmAPD arrays for photon counting and off-chip time-delay integration. This presentation/paper is a first look at the characterisation work being done at the UKATC for these devices.

Presenter: Dr. Shotaro Tada
Affiliation: Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, Japan
Title: Development of an InGaAs infrared detector for the JASMINE mission

Abstract

We present the latest progress in the development of an InGaAs infrared detector for the JASMINE mission, which targets Galactic Center astrometry and an exoplanet transit survey. Recent advances in detector characterization and testing, including a heavy-ion irradiation test, will be highlighted.

Presenter: Dr. Mark Clampin
Affiliation: NASA, USA
Invited Talk Title: The power of NASA Science

Abstract

Dr. Mark Clampin, Acting Deputy Associate Administrator (DAA), Science Mission Directorate (SMD), NASA will provide an overview of NASA's Science Mission Directorate portfolio and its priorities, including Moon to Mars. He will highlight research and recent results in the fields of Earth Science, Astrophysics, Heliophysics, Planetary Science, Biology and Fundamental Physics, and identify key sensor technologies that enable these missions, and programmatic needs for technology investments to enable future missions.

Presenter: Mr. Brock Parker
Affiliation: University of Arizona, USA
Title: Developing Skipper CCDs with enhanced UV QE

Abstract

Skipper charge-coupled devices (CCDs) are an inventive detector architecture with photon-counting ability utilizing multiple non-destructive readouts of pixel charge. Our group is working on developing Skipper CCDs with enhanced UV QE, and we provide the ongoing results of these efforts. We developed a Skipper CCD characterization setup, including cryogenic cooling, vacuum evacuation, UV compatibility, and readout electronics. We detail characterization results of initial testing on a 4-amplifier Skipper CCD, featuring read noise, dark current, and quantum efficiency, in preparation for 128-amplifier, UV enchanced Skipper CCDs. We compare two different sets of readout electronics quantitatively for noise performance.

In order to counteract one of the biggest challenges with Skipper CCDS, we also perform readout sequence optimization to achieve single electron-resolving power within readout times reasonable for astronomical applications. Low-noise Skipper CCDs have the potential to revolutionize ultra-faint imaging, such as the diffuse warm-hot circumgalactic medium, due to their greatly increased signal-to-noise ratio at low incident fluxes.

Presenter: Dr. Javier Reyes
Affiliation: European Southern Observatory, Germany
Title: Wireless solution for monitoring liquid nitrogen

Abstract

This paper presents the design, implementation, and validation of a wireless solution for monitoring liquid nitrogen (LN2) levels and pressure in ESO's nitrogen tanks, which are critical for

the operation of detector systems at both the Garching laboratories and Chilean observatories. The current method, relying on manual readings from C-Stic level gauges, poses a significant limitation for remotely operated systems. To address this, a battery-powered microcontroller-based system was developed to interface with the C-Stic gauge, acquire LN2 level measurements via a 4–20 mA signal, and transmit the data using a LoRa (Long Range) wireless transceiver.

The system also incorporates housekeeping data such as battery status and temperature, and requires minimal maintenance, with only periodic battery recharging. The choice of the LoRa protocol ensures long-range, low-power, and interference-resistant communication without dependence on existing infrastructure. This solution significantly enhances the automation, reliability, and maintainability of the LN2 supply monitoring process at ESO facilities.

Beyond ESO, this solution is suitable for implementation at other observatories worldwide, offering a scalable and cost-effective approach to LN2 and pressure tank monitoring. Its adoption would reduce the manpower required for regular maintenance and replacement of LN2 supply, improving overall operational efficiency in cryogenic detector systems.

Presenter: Dr. Jorge Jimenez
Affiliation: Institut de Fisica d'Altes Energies (IFAE), Spain
Title: Thermal Stress Evaluation for Hybridization Testing of 2k×2k IR FPAs

Abstract

We present a study evaluating thermal stress in hybridized 2k×2k infrared focal plane arrays (IR FPAs). The experimental results provide insights that can be used to optimize bonding conditions and enhance detector reliability under thermal cycling.

Presenter: Dr. Joseph Tufts
Affiliation: Semiconductor Technology Associates, Inc. (STA), USA
Title: ULTRASAT detector mosaic

Abstract

We describe the design, assembly, and testing of the ULTRASAT detector mosaic including the cryogenic flatness testing. OR We describe the pitfalls of reducing quantum efficiency (QE) absolute error below 1%.

Presenter: Dr. Bo Shojaei
Affiliation: Teledyne Digital Imaging, USA
Title: Teledyne's detector and readout integrated circuit (ROIC) technologies

Abstract

An overview of Teledyne's detector and readout integrated circuit (ROIC) technologies is presented. Infrared focal plane arrays produced from HgCdTe photovoltaic detectors serve as high performance image sensors for space missions and ground-based astronomy. Substrate removal technology enables the simultaneous detection of UV, visible and infrared radiation, and multiple mature ROIC architectures provide options for image sensors each suited for a given application.

The HxRG family of hybrid image sensors are optimized for faint signals and long exposures, and they operate with relatively low readout noise and low power consumption. The GeoSnap family of hybrid image sensors provide larger full wells and faster frame rates, and they are well

suited for imaging under relatively moderate to high light levels. Teledyne's general technology improvements and developments of HgCdTe detector architectures for future scientific detector needs are also reviewed.

Presenter: Prof. Cristobal Padilla
Affiliation: Institut de Fisica d'Altes Energies (IFAE), Spain
Title: Cryogenic Optical System for VLWIR Detector Characterization

Abstract

We present a comprehensive cryogenic vacuum and optical setup designed for the characterization of detectors with sensitivity up to 15 µm. The system is engineered to ensure that all optical components and necessary readout electronics are fully shielded from the detector, thereby preventing any thermal radiation contamination. The setup supports a variety of characterization techniques, offering flexibility and precision in detector testing.

Presenter: Dr. Bernard "Mic" Chaudoir
Affiliation: Teledyne Digital Imaging, USA
Title: ORION sensor high dynamic range and sub-electron dark noise image sensor

Abstract

NA

Presenter: Dr. Shane Jacobson
Affiliation: Noirlab, USA
Title: Peripheral wavefront sensors at Gemini

Abstract

The peripheral wavefront sensors have been integral components within Gemini North and South Observatories since the inception of the telescopes. When on-instrument wavefront sensors are not in use, they are responsible for off-axis fast guiding, tip-tilt, and focus correction. However, the existing e2v CCD39s and Astronomical Research Cameras Gen-II controllers are both obsolete with no prospects of acquiring additional spares. A new proposal addresses this obsolescence with a replacement Ximea xiJ camera utilizing a GPixel GSENSE400BSI. The rationale for choosing an sCMOS device is due to the extremely tight space envelope while keeping the current performance of 250 Hz frame rates and 7 e- RMS readout noise floor. The new system would not offer a substantial improvement to performance, but will provide a path to extend critical facility capabilities should a component finally fail.

Presenter: Mr. Brian Taylor
Affiliation: The Australian National University (ANU), Australia
Title: Cleaning of CCDs

Abstract

We present the results of a non invasive method for cleaning of a CCD.

Presenter: Dr. Julian Cuevas-Zepeda
Affiliation: University of Chicago, USA
Title: Non-destructive charge measurements with CCDs

Abstract

Single-photon counting charge-coupled devices (CCDs) capable of non-destructive charge measurements (NDCMs) are uniquely suited for detecting faint astronomical signals in ground- and space-based observatories. The n-type SiSeRO CCD is a fully depleted, thick, p-channel CCD that utilizes a double-gated n-MOSFET amplifier. In this work, we present a preliminary evaluation of the n-SiSeRO CCD as a candidate for future space missions—focusing on its energy resolution and improved readout speeds.

Presenter: Mr. Miqueas Gamero
Affiliation: XXX
Title: Characterization of a MAS-CCD for astronomical observations

Abstract

We present the characterization of a MAS-CCD for astronomical observations. We focus on the interplay between spurious charge (SC) and full-well (FW) capacity. Minimizing SC reduces noise, while maximizing FW ensures sufficient charge collection. We introduce a novel SC estimation method enabling fast, precise measurement. Finally, we describe ongoing installation on a telescope at CTIO, where we expect to validate the optimization methods presented under real observing conditions.

Presenter: Dr. Eduardo Medinaceli
Affiliation: Istituto Nazionale di Astrofisica (INAF), Italy
Title: ESA's mission Ariel

Abstract

ESA's mission Ariel, Atmospheric Remote-sensing Infrared Exoplanet Large-survey, planned to be launch on 20209 will mainly study the atmospheres components of thousand exoplanets. Ariel will be equipped with the Fine Guidance System (FGS) module containing three visible to near-infrared photometer channels in the range 500-1100 nm, two used as guidance sensors as well as for science implementing two HAWAII-2RG detectors. And a low-resolution near-infrared spectrometer (1.1 to 1.95 micrometres) extending the spectroscopic range of the mission. The poster will address the latest characterization and performances results for the FGS system.

Presenter: Guillaume Huber
Affiliation: University of Hawaii, Institute for Astronomy
Title: Latest characterisation results of 1kx1k LmAPDs for ultra low noise NIR astronomy

Abstract:

The University of Hawai□i and Leonardo UK are pursuing the development of large format Linear-mode avalanche photodiodes (LmAPDs) designed for ultra-low signal astronomy applications. In recent years, those HgCdTe infrared arrays have shown promising noise performance and are now a serious candidate for NASA's HWO mission. In this presentation, we reviewmrecent measurements of dark-current, glow, read noise, and focus in particular on the effects of glow and persistence on single-photon detection capabilities.

Presenter: Mr. Mark Downing
Affiliation: The Australian National University (ANU), Australia
Title: MAVIS, Multi-Conjugate Adaptive Optics Assisted Visible Imager and Spectrograph

Abstract

MAVIS, Multi-Conjugate Adaptive Optics Assisted Visible Imager and Spectrograph, will be installed on ESO's Very Large Telescope, UT4, in Chile. It uses multiple deformable mirrors and wavefront sensors to remove the effects of atmospheric turbulence, allowing for high-resolution imaging and spectroscopy.

The Science detector system uses three Teledyne CCD290-99 CCDs in separate Cryostats, two for the spectrograph and one for the Imager. Each CCD will be read out by one of the new ESO NGCII Detector Controller. The paper will describe the Detector System and the novel techniques, as applied to NGCII such as Digital Corelated Sampling and differential dummy output, being deployed to achieve the critical low read noise required for the instrument success.

Presenter: Dr. Martin Roth
Affiliation: Deutsches Zentrum für Astrophysik, Görlitz and Leibniz-Institut für Astrophysik Potsdam (AIP), Germany
Title: Lab test and commissioning results for qCMOS camera at Calar Alto

Abstract

Quantizing detectors have already attracted considerable attention at the previous SDW2022 in Potsdam, including a round table on the topic. In the meantime, off-the-shelf camera systems have appeared on the market that complement the existing EMCCD technology with new approaches. The Hamamatsu qCMOS camera is such a system that combines fast readout (up to 125 fps) with low read noise (0.3 e-). The emerging German Center for Astrophysics (DZA) has procured two such cameras for installation at the 1.2m telescopes of Calar Alto Observatory in southern Spain, and Teide Observatory, Tenerife. We will report about first experience from lab tests and a first commissioning run in June 2025 and discuss applications for short cadence time domain astronomy.

Presenter: Dr. Gregory Bredthauer
Affiliation: Semiconductor Technology Associates, Inc. (STA), USA
Title: Custom CCD controllers by STA

Abstract

STA specializes in the development of custom CCDs, controllers, and imaging systems for a wide variety of applications. We discuss recent sensor fabrication efforts, custom CCD applications including high channel count skippers, controller advancements, and new cryostat hardware.

Presenter: Mr. Annino Vaccarella
Affiliation: The Australian National University (ANU), Australia
Title: The Rosella controller system

Abstract

The Rosella system is a compact detector controller for space applications. Rosella is modular and the hardware has been designed for reconfigurability giving it the ability to operate virtually any CMOS-based sensor array. Rosella is a field-programmable gate array (FPGA) based

design which provides a high degree of flexibility. Arbitrary, user-defined detector clock pattern sequences are stored in FPGA RAM and can be modified on-demand through a communications interface. This supports any device-specific special functions such as reference channels and area-of-interest readout ('windowing'). Rosella supports up to 32 video channels with parallel conversion of analog pixel data at 16-bit resolution with optimisations for high frame rates or low readout noise. A flexible high-speed interface allows data streaming over various standard camera and spacecraft bus protocols, including direct communication with artificial intelligence platforms for on-board processing.

A combination of strategies are implemented to enhance tolerance to radiation in a low Earth orbit environment. Some digital functionality of the FPGA is triplicated and a voting system is used to mask and report errors. Error correcting codes are also used to detect and report errors. A radiation tolerant microcontroller is a system monitor and it corrects cumulative FPGA configuration errors by reprogramming it from a golden flash memory.

Presenter: Dr. Rosario Cosentino
Affiliation: Istituto Nazionale di Astrofisica (INAF), Italy
Title: SPAD camera prototype development

Abstract

We present a 64×64 pixel SPAD camera prototype developed as a pathfinder for a 2000×2000 sensor in the LPI project. The system integrates a thermoelectrically cooled SPAD array and a custom FPGA on a single PCB to reduce crosstalk and enable high-speed readout. A built-in, sub-nanosecond time-tagging system synchronized via White Rabbit makes it well-suited for applications demanding precise timing and single-photon sensitivity.

Presenter: Mr. Mathias Richerzhagen
Affiliation: European Southern Observatory (ESO), Germany
Title: ESO's next generation detector controller

Abstract

ESO's next generation of detector controller is now functional and has been delivered to our first instrument, a SCAO for the ELT METIS instrument, using the SAPHIRA eAPD detector. It has also been tested and validated with the HAWAII family of IR CMOS detectors. At present it is going through testing with a CCD and later in the year it will be tested with Geosnap, a fully digital IR CMOS detector, as well as testing of the synchronisation of multiple controllers using "white rabbit". We give an outline of the architecture of this new detector controller which allows interfacing and control to such a diverse type of astronomical detectors.*

We also give details about our decisions made on the use of inhouse designed boards for specific detectors and COTS hardware for the backbone of the controller. The NGCII controller has been designed for all future VLT and ELT instruments and we state why we went down the path of designing a new controller rather upgrading our present NGC system. Detailed testing and acceptance has taken place with CMOS detectors and we give results on measured performance with these detectors.

Presenter: Mr. Kensho Tanaka
Affiliation: Institute of Astronomy, University of Tokyo,
Title: NINJA, the LTAO-optimised IR spectrograph for SUBARU

Abstract

Our team is developing NINJA, an LTAO-optimized infrared spectrograph (0.9-2.5μm) for Subaru Telescope. The detector system consists of a HAWAII-2RG (2.5 μm cutoff) detector, a SIDECAR ASIC, and a MACIE interface board. The target readout noise is 4 e rms. To achieve this, it

is essential to optimize the detector system. We describe how the reference voltages, bias voltages, and gain settings affect the readout noise, and present the results of our optimization efforts.

Presenter: Mr. Jason Griesbach
Affiliation: San Francisco Amateur Astronomers
Title: Vision Enhancement for Astronomical Outreach

Abstract

Although electronically assisted imaging has been around for decades, the past few years have seen rapid advancements and many new products in the amateur market. This presentation will provide an overview of both commercial and homebrew innovations that are redefining the viewing experience, creating novel opportunities for astronomical outreach.

Presenter: Mr Dennis Marchais
Affiliation: Airbus
Invited Talk Title: Optical Instruments and Detector developments at Airbus Defence and Space

Abstract

NA

Presenter: Dr. Matthew Hicks
Affiliation: Leonardo, UK
Title: Overview of Leonardo UK high performance infrared detectors for space and astronomy missions

Abstract

Leonardo UK have a wide portfolio of Infrared (IR) detector products aimed at the space and astronomy market. Space and astronomy continues to be a significant and growing part of the Leonardo UK detectors business.

Leonardo produces Deuterated L-Alanine doped Triglycine Sulphate (DLATGS) high performance, uncooled, single element pyroelectric detectors in high volumes for commercial scientific instruments. This technology has been exploited recently to produce modified-off-the-shelf (MOTS) detectors for recent space missions such as the NASA OSIRIS-REx asteroid exploration mission and the ESA FORUM earth observation mission.

Previously Leonardo has provided photoconductive HgCdTe material for space programs including IASI-NG which will launch in 2025. More recently focus has shifted to array technology based on bandgap-engineered HgCdTe, grown by Metal Organic Vapour Phase Epitaxy (MOVPE). This technology allows the flexibility to cover the full wavelength range from shortwave (SW) to the very long wave (VLW) as well as allowing innovations such as linear-mode, avalanche photodiode arrays (LmAPDs).

LmAPDs, sensitive in the SW, have firmly established themselves as critical for wavefront sensing on ground-based telescopes and their increased sensitivity is being explored for imaging applications. Medium wave (MW) and long wave (LW) detectors have been provided for the recent IASI-NG and NASA PACE missions. In addition, MW commercial off-the-shelf (COTS) sensors have been supplied for a low-cost small satellite mission.
An overview of these and other Leonardo detectors for space programs will be presented. Future space mission opportunities will be discussed.

Presenter: Mr. Muthu Jeganathan
Affiliation: Teledyne Digital Imaging, USA
Title: Development of 10µm pitch, 4Kx4K, VLWIR Detector Array at Teledyne

Abstract

Wide-field and high-resolution needs of modern space-based imaging payloads are pushing the limits of large-format, high quality, IR detector arrays. Teledyne has delivered several tens of 4Kx4K, 10-micron pitch, mid-wave IR HgCdTe detector with cutoff as high as 5.5 um arrays that operate from 80-120K temperature. However, producing a substantially longer cutoff wavelength array has presented challenges. In this presentation, we report on results from recent development effort on growth & processing of very long wave IR (VLWIR, with ~14.5 um cutoff) HgCdTe detector material, and their hybridization to mature Geosnap-10, 10 micron-pitch, 4Kx4K ROICs. Several of these focal plane modules were built, and tested at 45K temperature for dark current, photo-response and uniformity.

Presenter: Dr. Martin Roth
Affiliation: Deutsches Zentrum für Astrophysik, Görlitz and Leibniz-Institut für Astrophysik Potsdam (AIP), Germany
Title: DZA German Center for Astrophysics: CMOS development plans

Abstract

The emerging German Center for Astrophysics (DZA) is currently being created from scratch in the small city of Görlitz, on the polish border near Dresden. The raison-d'etre of a national research center for Astrophysics, motivated by the long-standing demand for such a facility, is related to a successful application for federal transformation funds set in place for the legal end of coal mining in Germany as dictated by global climate change.

The mission of DZA is to provide the German community with critical mass for large scale international projects and technology development, that would be beyond the scope of the Max-Planck-Society, or other German research organizations and universities.

Amongst several other topics of interest, the development of detector technologies has been identified as a possible activity. Embedded in a major European cluster of semiconductor industries and associated research institutes, both at the Technical University Dresden and at several Fraunhofer Institutes of the region, DZA has already launched a pilot study with Fraunhofer IPMS towards the future development of CMOS sensors for use in astronomy. The talk will describe the roadmap and the current status concerning this goal.

Presenters: Dr. Michael Bottom and Mr. Guillaume Huber
Affiliation: Institute for Astronomy, University of Hawai'I, USA
Title: Overview of the University of Hawaii's program to develop a large-format APD

Abstract

I present an overview of the University of Hawaii's program to develop a large-format, science-grade linear mode avalanche photodiode array suitable for extremely sensitive ground and space observations. Our current sensors are 1 megapixel with total noise an order of magnitude better than conventional HgCdTe infrared arrays such as those used on JWST, including the ability to noiselessly detect single photons in low-flux operation. I present the design, laboratory data and first on-sky results. With our industrial partners, we are now developing 4 megapixel sensors that are considered a candidate detector technology for the Habitable Worlds Observatory, NASA's next great flagship mission.

Presenter: Dr. Gert Finger
Affiliation: Max-Planck-Institut, extraterrestrische Physik, MPE Garching, Germany
Title: APDs for Extreme adaptive optics

Abstract

For extreme adaptive optics a larger format 512x512 pixel ME1120 linear mode electron avalanche photodiode array has been developed, which has 64 parallel video outputs and can be read at a frame rate of 2KHz. The optical quantum efficiency of the bare ROIC at □=780nm has been measured to be QE=5.8E-7, and 1.7 million photons generate 1 electron. Lower QE means better shielding of the infrared detector from ROIC glow.

Presenter: Dr. Takehiko Wada
Affiliation: National Astronomical Observatory of Japan (NOAJ), Japan
Title: Development of IR-SOIPIX, a monolithic Si-BIB mid-infrared imaging sensor

Abstract

The development status of IR-SOIPIX, a monolithic Si-BIB mid-infrared imaging sensor based on SOI-CMOS technology, will be presented. If two presentations are permitted, I would also like to report on recent progress in the "JASMINE" project (Japan Astrometry Satellite Mission for Infrared Exploration). In addition, the recent development of a 2K×2K InGaAs imaging sensor for the JASMINE project will be presented.

Presenter: Dr. Rob Green
Affiliation: Jet Propulsion Laboratory (JPL) – NASA, USA
Invited talk Title: From 32x32 to 3072x512 MCT, 43 years and >20 Imaging Spectroscopy Missions for Science, Applications, Discovery, and Exploration on Earth and Across the Solar System

Abstract

In the 1970s NASA realized that a new class of instrumentation was becoming feasible—an instrument that measured a spectrum for every point in an image, an imaging spectrometer. Building on this insight, JPL proposed the Airborne Imaging Spectrometer (AIS) in 1979 with a grating and a 32 × 32-element mercury-cadmium-telluride (MCT) detector array operating in the short-wavelength infrared at its core. AIS first flew in 1982 and made geologic discoveries that validated the imaging-spectroscopy concept. Its successor, the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS), followed in 1986 and extended the measurement to the full visible-to-short-wavelength infrared (VSWIR) spectral range.

Over the ensuing decades, imaging spectrometers operating in the optical spectrum have been deployed throughout the solar system for science, discovery, and exploration. A key discovery was the presence of water/hydroxyl compounds on the illuminated surface of the Moon in 2009.

In Earth-orbit, imaging-spectroscopy observations are now delivering new and important science and applications across the atmosphere, biosphere, cryosphere, geosphere, and hydrosphere domains of the Earth system. New science- and applications-focused products are being generated for critical minerals, fire fuels, agriculture, water quality, water resources, and more.

Now in 2025, detector-array technology has advanced such that a pair of 3072 × 512 digital-out MCT arrays can enable a 190-km swath VSWIR Earth-imaging spectrometer with 30-m ground sampling, delivering more than 150 million spectra per second and measuring the Earth every 16 days. This paper describes key elements of the advance of imaging-spectrometer instrumentation to the present, highlights key discoveries, results, and paradigm shifts caused by their observations, and outlines opportunities for the future.

Presenter: Mr. Peter Orel
Affiliation: Stanford, USA
Title: High-performance X-ray cameras for future strategic astronomy missions

Abstract

We have been developing high-performance X-ray cameras for future strategic astronomy missions with applications in both X-rays and optical. By leveraging the CCD process at MIT-LL and developing our own fast and low-noise readout ASIC, we achieved below 3e- rms noise at 2MHz. Concurrently, we work on a novel on-chip charge detector for CCDs called the Single Electron Sensitive ReadOut (SiSeRO). With its ability to do RNDR, a readout noise of ~0.5e- rms at 625kHz has been demonstrated.

Presenter: Dr. Dileep Reddy
Affiliation: University of Colorado, USA
Title: Superconducting nanowire single-photon detectors (SNSPD)

Abstract

Superconducting nanowire single-photon detectors (SNSPD), in single-pixel form have been demonstrated to have very high detection efficiencies (> 98% in the infrared at 1550 nm, ~80% in the UV at 370 nm), insensitivity to low-energy photons (excellent solar blindness), and high dynamic range (>9 orders of magnitude). The performance of megapixel (and higher) arrays of SNSPDs would be a valuable addition to the infrared/optical/ultraviolet detection toolkit, despite the cryogenic requirements.

Presenter: Dr. Brian Schmidt
Affiliation: The Australian National University, Australia
Title: NA

Abstract

NA

Presenter: Dr. Kentaro Motohara
Affiliation: National Astronomical Observatory of Japan, Japan
Invited Talk Title: SWIMS: a new NIR MOS spectrograph/imager for TAO 6.5m telescope

Abstract

SWIMS is a new NIR MOS spectrograph/imager for TAO 6.5m telescope, which is now under construction in Chile by Univ. Tokyo. SWIMS has two focal planes covering red (1.4-2.5um) and blue (0.9-1.4um) wavelength, each covered by four H2RG arrays. Current status of its development, especially emphasized on detector system, will be presented.

Presenter: Dr. Julian Cuevas-Sepeda
Affiliation: University of Chicago, USA
Title: A Preliminary Evaluation on the n-SiSeRO CCD

Abstract

Novel sensor development is inherently expensive. During early testing, significant time is required to optimize operating parameters before performance characterization under various conditions. This calibration phase can consume a year or more of expert effort—representing a major investment in routine work. In this work, we present a machine learning-based technique for automated sensor calibration that autonomously identifies optimal operating states.

Presenter: Dr. Nicolas Baier
Affiliation: CEA, France
Title: PSF sampling with the EBIC probe

Abstract

We propose to use the EBIC probe on a functional IRFPA to measure PSF and MTF of the pixels. The main advantage is the spot size of the beam, much more smaller than Airy disk of optical technics. Moreover, we will use the same setup to map the intrapixel persistence. We will demonstrate that EBIC probing is particularly well suited for small pixel pitch (7.5µm and below).

Presenter: Mr. Marco Bonati
Affiliation: Noirlab, USA
Title: MAS skipper CCD performance on the CTIO0.9m telescope

Abstract

We present the engineering details, instrument integration and detector characterization of the first on-sky MAS skipper CCD test, performed on the 0.9m telescope at CTIO. The experiment was a collaboration between NOIRLab, FNAL and UChicago, involving backside processing, packaging, testing and telescope integration of an engineering -grade MAS skipper with 16 in-line output amplifiers. Actual on-sky observations and results are discussed in detail in a complementary paper by Montalban et al.

Presenter: Dr. Fernando Pedichini
Affiliation: Istituto Nazionale di Astrofisica, Italy
Title: DATT: The Detector Advanced Test Track

Abstract

The talk is about an advanced test bench (hosted in a clean room) where is possible to test and characterize detectors and small electro-optical instrumentation up to 150kg by using not only standard sources and targets but also astrophisical simulated objects and atmospheric turbulence.

Presenter: Mr. Kenneth Lin
Affiliation: UC Berkeley, USA
Title: Optimisation the MAS CCD readout

Abstract

Multi-amplifier sensing (MAS) charge-coupled devices (CCDs) can reach sub-electron readout noise with a readout speed comparable to current astronomy CCDs. I present progress in optimizing the MAS CCD readout to achieve < 1 e- rms/px noise with faster read times (19 μs/px) demonstrated using a 16-channel prototype detector, development of readout electronics for the recently fabricated 4k x 4k 128-channel MAS CCDs, and our roadmap for lab-testing these for the DESI-2 spectrograph upgrade effort.

Presenter: Dr. Brenda Aurea Cervantes-Vergara
Affiliation: Fermilab, USA
Title: p-channel skipper-CCDs

Abstract

Thick, p-channel skipper-CCDs were irradiated with protons up to 10^10 10-MeV-equiv. p/cm^2 to assess their feasibility in high-radiation environments. Single-electron sensitivity was preserved. Unlike standard CCDs, skippers reveal displacement damage as pixels with few-e- depositions from trap emission. Divacancies (most abundant) and CiOi defects (most impactful) were identified through pocket pumping. Microwave annealing for damage mitigation will be discussed.

Presenter: Prof. Erika Hamden
Affiliation: University of Arizona, USA
Title: UV optimization on Skipper CCDs

Abstract

We'll present work to implement UV optimization on Skipper CCDs. Skipper CCDs are a type of low-noise CCD imager, which uses a non-destructive readout to sample each pixel many times, reducing readnoise to a low enough level that photon counting can be achieved. These devices have been demonstrated in dark matter detection experiments, and are now being developed for fast readout astronomical use. We will discuss the work, funded by NASA and Heising-Simons,to extend use into space ultraviolet.

Presenter: Dr. Guillermo Fernandez Moroni
Affiliation: Fermilab, USA
Title: MAS-CCD development at Fermi Lab

Abstract

I will present the progress in the development of the Multiple-Amplifier-Sensing CCD (MAS-CCD) at Fermilab. It updates work since the proof-of-concept talk I gave at SDW2022, covering current and planned instrumentation of the sensor, optimization of intrinsic noise sources, sense node transfer studies, telescope validation, and future plans. Students and postdocs involved in MAS-CCD will provide further details and insight into some of these topics.

Presenter: Dr. Agustin Lapi
Affiliation: University of Chicago
Title: MAS-CCD readout optimisation

Abstract

Skipper-CCDs are promising for astronomical applications due to their noise-reducing architecture, offering a significant advantage in low-signal observations. Their successor, the MAS-CCD, resolves electrons at ~80kpix/s, enabling broader scientific exploration. I will discuss the MAS-CCD readout optimization for studying microlensing events caused by primordial black holes, along with preliminary on-sky results showing the performance of these new strategies when implemented at a telescope.

Presenter: Dr. Brandon Roach
Affiliation: University of Chicago, USA
Title: Development of p-channel skipper CCDs for astronomy

Abstract

Development of p-channel skipper CCDs for astronomy" Skipper CCDs are a rapidly maturing technology able to count single optical photons. I will review the status of p-channel skipper CCDs for astronomy, including optimization and on-sky testing at the 4.1-m SOAR telescope in Chile. Looking to future space missions, I will present new experimental results concerning long-term cosmic-ray degradation on key parameters for photon-starved observations, e.g. dark current, CTI, and readout noise.

Presenter: Mr. Theodore Grosson
Affiliation: University of Victoria, Canada
Title: SPAD array to observe the visible PSF of the REVOLT AO testbench

Abstract

Adaptive optics is critical for improving resolution by reducing the size of an image PSF, but it is not necessarily clear how the PSF evolves at AO system timescales (~1000 Hz). We use a commercial SPAD array to observe the visible PSF of the REVOLT AO testbench at 96 kHz. We discuss insights gained from these observations as well as avenues for the use of this detector in time-resolved wavefront sensing and lucky imaging behind an AO system.

Presenter: Mr. Christopher Montalban
Affiliation: Universidad de la Serena, Chile
Title: First on sky application of MAS Skipper CCDs for astronomical imaging

Abstract

First on sky application of MAS Skipper CCDs for astronomical imaging. This novel sensor combines ultra-low readout noise with normal readout times via in-line amplifiers for photometry and high-cadence. After fine-tuning electronics, we characterized key parameters across 16 amplifiers. System tested at CTIO, achieving sub-2 electron RMS readout noise, demonstrating reliable multichannel readout. We asses these results with low surface brightness objects, exoplanet light curves and geosats.

Presenter: Mr. Blas Irigoyen-Gimenez
Affiliation: Universidad Nacional del Sur, Bahía Blanca, Argentina.
Title: Enhancing SNR of Skipper CCDs for astronomical applications

Abstract

We report results aimed at enhancing the signal-to-noise ratio (SNR) of Skipper CCDs for astronomical applications. Results on implementing backside processing for fully depleted Skipper CCDs using arsenic ion implantation and microwave annealing are presented, along with new readout operations to minimize the readout time of the Multiple Amplifier Sensing CCD (MAS-CCD). Simulations, experimental progress, and the resultant SNR are included, together with its application at a telescope in Chile.

Presenter: Mr. Claudio Chavez
Affiliation: FermiLab, USA
Title: Results of the Skipper-CMOS sensor developed by Fermilab and Tower Jazz

Abstract

We present the first matrix-level results of the Skipper-CMOS sensor developed by Fermilab and Tower Jazz. We demonstrated sub-electron resolution using up to 2000 skips per pixel at cryogenic temperatures. The device integrates a CCD, pinned photodiode, and floating gate in a CMOS process. Early results show discrete charge histograms and noise below 0.1 e rms. Despite challenges like dark current and dumping inefficiencies, these results validate the technology and guide future improvements.

Presenter: Dr. Roger Smith
Affiliation: Caltech, USA
Invited talk Title: Quantizing CCDs for Astronomy

Abstract

*We report on progress developing a 4K*2K frame transfer CCD which reads out noiselessly in less than 2 minutes. A science demonstration is planned on U and G channels of the Next Generation Palomar Spectrograph in 2027. STA have achieved 0.15 e- read noise at < 2 .5 ms/ pixel with a lower channel count skipper CCD with unoptimized transistors. The differential output configuration planned for the final design proved to be essential to achieving this low noise. Output transistor optimization is being explored by STA to improve the speed noise trade, while high channel count electronics are being developed by Caltech to meet the readout time goal.*

We present plans to address the packaging challenges presented by the ~290 electrical connections, and report on the prototyping of the compact Multichannel Video Processor to be located close to the CCD. Noiseless readout enables finer wavelength and/or spatial sampling in future spectrographs, but this results in collection of dark current from more pixels. Most epitaxial n-channel CCDs exhibit dark current floor around 10-3 to 10-4 e-/s/15μm_pixel while dark current less than 10-8 has been reported for bulk p-channel CCDs.

We report on dark current tests for bulk nchannel CCDs aimed at determining whether it will be necessary to switch to p-channel to reap the full benefits of charge quantization.

Presenter: Dr. Manoj Varma Sri Vatchavai
Affiliation: Leibniz Institute for Astrophysics Potsdam (AIP), Germany
Title: The GaiaNIR mission

Abstract

The GaiaNIR mission is a proposed near-infrared extension of ESA's Gaia satellite. This study at innoFSPEC, AIP focuses on the laboratory characterization of Large SAPHIRA arrays using a NGC 2 controller. We characterize the detector, assessing parameters such as dark current, gain stability, linearity, noise behavior under avalanche operation, and response uniformity, to evaluate its suitability for the GaiaNIR payload.

Presenter: Dr. Sukwon Youn
Affiliation: Seoul National University, Korea
Title: Space radiation detectors for lunar surface radiation environment

Abstract

The LVRAD (Lunar Vehicle Radiation Dosimeter) is a set of space radiation detectors for the lunar surface radiation environment developed in Korea and proposed to the CLPS (Commercial Lunar Payload Services) program. It includes instruments designed to evaluate the biological effects of charged particles and neutrons on the lunar surface, as well as to detect water ice in the lunar regolith. This presentation will introduce the design of LVRAD detectors and the calibration process for performance verification.

Presenter: Dr. Clara Bataillon
Affiliation: CEA Saclay, France
Title: Infrared spectroscopic instrument for the ARIEL mission

Abstract

AIRS is the infrared spectroscopic instrument for the Atmospheric Remote-sensing Infrared Exoplanet Large-Survey (ARIEL) mission, scheduled for launch in 2030. The AIRS instrument consists of two Teledyne H1RG detectors, covering the wavelength ranges 1.95-3.90μm and 3.90-7.80μm respectively. This overview will present the initial results of the characterization of these detectors, which are actively cooled to 42K.

Presenter: Dr. Ralf Kohley
Affiliation: European Space Agency, Spain
Title: Pixels with purpose: science and wonder in Euclid's Colourful Universe

Abstract

Challenges during the acquisition and processing of the data from the Early Release Observation (ERO) programme of the Euclid space mission are presented culminating in the series of stunning images presented to the general public in two ESA events in November 2023 and May 2024.

Presenter: Dr. Herve Geoffray
Affiliation: Centre National d'études Spatiales (CNES), France
Title: CNES recent developments for infrared space missions: Status and prospects

Abstract

In this paper, we present both a status on scientific mission with IR capabilities, for which CNES is strongly involved and CNES future developments and R&T programs.

Presenter: Dr. Eloy Hernandez
Affiliation: European Space Agency, The Netherlands
Title: Development of the IBEX detector at ESA

Abstract

ESA's Payload Validation Section is contributing to the development of the IBEX detector, a 2k x 2k MCT large-format APD array for astrophysical applications developed by Leonardo UK. This talk will present an overview of the characterization campaigns, summarize the obtained electro-optical performance, and provide an update on the ongoing IBEX development activities.

Presenter: Dr. Matthew Sonam
Affiliation: European Space Agency (ESA), The Netherlands
Invited talk Title: Detector Developments Supported by the European Space Agency

Abstract

NA

Presenter: Dr. Nathan Saffold
Affiliation: Fermilab, USA
Title: Demonstrating skipper-CCD operation in space with DarkNESS

Abstract

Demonstrating skipper-CCD operation in space with DarkNESS: The DarkNESS mission will deploy an array of skipper-CCDs on a 6U CubeSat in Low Earth Orbit to conduct a dark matter search. These measurements will demonstrate the single-electron counting capabilities of skipper-CCDs in the space environment, and pave the way for the future implementation of skipper-CCDs for space-based imaging. This contribution will describe the DarkNESS mission in preparation for its launch in 2026.

Presenter: Dr. Oswald Siegmund
Affiliation: University of Berkeley, USA
Title: Microchannel plate detector schemes for UV photon counting imaging detectors for NASA and ESA

Abstract

Over a 40 year period we have been developing and implementing miscrochannel plate detetcor schemes for UV photon countin imaging detectors for numerous missions for NASA ad ESA that span Earth atmospheric observations, planetary missions, astrophysics, and heliophysics. Platforms include sub-orbital, cubesats and minisats, SMEX and MIDEX, planetary satellites and flagship missions. We will discuss recent developments in microchannel plate detectors and electronics for UV spaceflight sensors.

Presenter: Dr. Eduardo Medinaceli
Affiliation: Istituto Nazionale di Astrofisica (INAF), Italy
Title: Euclid's Detector Array

Abstract

ESA's Euclid mission, launched in July 2023, has been conducting its nominal survey since early 2024. Euclid is designed to perform an extragalactic survey using both visible and near-infrared light. To detect infrared radiation, the spacecraft is equipped with the Near-Infrared Spectro-Photometer (NISP), which features a focal plane array composed of 16 Teledyne HAWAII-2RG detectors. The presentation will address the on-board data reduction approach, including the control of the systematics in the signal estimation.

Presenter: Dr. Stephane Demiguel
Affiliation: Thales Alenia Space
Title: Detection chains evolutions for space missions at Thales Alenia Space

Abstract

Thales Alenia Space has been offering optical high-performance and high-resolution instruments for surveillance, observation, meteo and science applications, drawn on over 40 years of experience to propose a complete range of optical systems. In this context, detection chains solutions have been developed to meet more and more challenging missions requirements. Traditional detection chain architecture of analogue detectors such as CCD and Infrared detectors arrays are coupled with a front-end electronic ensuring the functions of video pre-amplification, clock drivers, and low noise biases, followed by a video acquisition electronics including ADC conversion, clocks generation, command/control signals, supply voltages, thermal sensors management, and some various digital functions.

The Meteosat Third Generation (MTG) ESA project which have been launched successfully in 2022 for the FCI (Flexible Combined Imager) and 2025 for the IRS (InfraRed Sounder) missions respectively, included the first detection chain evolution beginning of the 2010's at Thales Alenia Space by operating an analogue CMOS detector.

Considering the integration potential of the CMOS technology, the detection chains architecture were moving on monolithic digital detectors in particular on VNIR band followed by more compact video electronics exhibiting more complex data processing. These evolutions were chosen for the CO2M ESA mission in 2020.

The compactness trends have been flown down recently to payload level at Thales Alenia Space by proposing novel flight proven solution based on high-resolution Smart optical Telescope for high-resolution observation applications. In this perspective, developments have been speeding up to COTS digital detectors in compact cameras including well-sized digital processing with adequate space components level to address different classes of missions (low-end, mid-end or high-end).

Presenter: Ms. Yassine Faris
Affiliation: Laboratoire de Physique Nucléaire et des Hautes Énergies), CNRS / IN2P3, LPNHE Paris (France)
Title: Wavelength dependence of the brighter–fatter effect in LSST CCDs

Abstract

The brighter-fatter effect (BF) is a subtle yet critical manifestation of pixel-to-pixel correlations in CCDs, where brighter sources induce a redistribution of charge that broadens object shapes. Caused by electrostatic deflections from accumulated charge, the BF effect introduces flux-dependent distortions that can bias precision astronomical measurements, notably in weak lensing surveys. In this study, we investigate the influence of the incident wavelength on BF coefficients, using both LSST camera data and electrostatic modelling. We explore how

variations in illumination modify the local electric field within the CCD, thereby altering charge drift paths. We are developing an electrostatic model to quantify these distortions. Our results show that BF coefficients depend not only on charge accumulation but also on the incident wavelength, adding a new layer of complexity to their interpretation. This has direct implications for calibration strategies and the accuracy of shape measurements in current and future imaging surveys.

Presenter: Dr. Kosuke Kushibiki
Affiliation: National Astronomical Observatory of Japan, Japan
Title: ULTIMATE-Subaru is a next-generation near-infrared instrumentation project for the Subaru Telescope

Abstract

ULTIMATE-Subaru is a next-generation near-infrared instrumentation project for the Subaru Telescope. It includes a Ground-Layer Adaptive Optics (GLAO) system, which delivers an image quality of 0.2 arcsec FWHM in the K-band over a 20-arcmin field of view, and a Wide-Field Imager (WFI) with various broad, medium, and narrow-band filters. In this presentation, I will provide an overview of the project and current development status, with a particular focus on their detector systems.

Presenter: Shouleh Nikzad
Affiliation: Jet Propulsion Laboratory, USA
Invited talk Title: Science-Focused Technology Development: Detectors for Astronomy, Earth Science, and Planetary Science

Abstract

NA

Presenter: Dr. Gustavo Rahmer
Affiliation: Giant Magellan telescope Observatory (GMTO), USA
Title: Status of the Science Instruments and their Detector Plans at the Giant Magellan Telescope

Abstract

We present a description and status of the first-generation science instruments for the Giant Magellan Telescope (GMT), and the current plans for their scientific detectors. The first-generation suite includes visible and infrared spectrographs with high (single-object) and moderate (multi-object) spectral resolution, an infrared diffraction limited imager, and a visible and near-infrared extreme adaptive optics (Ex-AO) and coronagraph system. G-CLEF (GMT Consortium Large Earth Finder) is a high-resolution visible-light echelle spectrograph with red and blue channels, using large-format CCDs. GMACS (GMT wide field multi-object spectrograph) is a workhorse moderate-dispersion visible-light multi-object spectrograph with red and blue channels. It will have a mosaic of 4Kx4K CCDs.

GMTNIRS (GMT Near Infrared Spectrograph) is a near- to thermal-IR single-object echelle spectrograph, with 6 channels (J, H, K, L1, L2 and M). The detector of choice is H2RG (one per channel).

GMTIFS is a diffraction-limited imager and IFS operating across the YJHK-spectral bands. Both the imager and the IFS will use H4RG detectors. For its on-instrument WFS, the emerging eAPD technology is being evaluated.

GMagAO-X is an Ex-AO system for very high contrast imaging and spectroscopy (e.g. by feeding the high spectral resolution spectrographs G-CLEF and GMTNIRS) of extrasolar planets, including nearby potentially habitable terrestrial worlds in reflected light. Detectors under consideration include EMCCDs and CMOS. G-CLEF is already in fabrication, while all the other instruments have already had their Preliminary Design Reviews.

The first-generation suite also includes a robotic fiber-feed system called MANIFEST, which enables spectroscopy on objects anywhere in the 20 arcmin field of view of the telescope with custom fibers for G-CLEF and GMACS.

We also discuss the visible and infrared cameras (called ComCam and AOTC, respectively) that will be used for alignment, verification, and commissioning of the active and adaptive optics modes of the telescope, as well as enable early science and outreach activities.

Presenter: Mr. Javier Valenzuela
Affiliation: European Southern Observatory, Chile
Title: Mitigating anomalies in astronomical images at Paranal

Abstract

This paper presents a detailed account of the methodologies implemented at Paranal Observatory for the detection, analysis, and mitigation of anomalies in astronomical imaging detectors. The scope encompasses both infrared (IR) and charge-coupled device (CCD) detectors operating across a broad array of scientific instruments, including Adaptive Optics Wavefront Sensors (AOWFS) integrated into various AO systems.

A multi-layered diagnostic framework is outlined, incorporating telemetry data mining, advanced image analysis, cryo-vacuum laboratory procedures, and signal validation through purpose-built test benches. The evolution of these techniques is substantiated with statistical evaluations of failure modes, recurrence frequencies, and their impact on operational efficiency and scientific data quality.

Illustrative cases involve degradation in video signal chains, emergence of image artifacts, thermal control instabilities, and interface-level failures affecting first-generation readout electronics platforms such as NGC I. These strategies have been developed through close collaboration between the Paranal Detector Team and the ESO Detector Group, forming a critical foundation for maintaining instrument reliability and ensuring readiness for the deployment of next-generation VLT and ELT-class detectors.

The study concludes by emphasizing key operational insights, the strategic role of inter-institutional collaboration, and the roadmap for enhancing the capabilities of the Detector Laboratory in anticipation of future demands in astronomical instrumentation.

Presenter: Prof. Jian Wang
Affiliation: University of Science and technology of China, China
Title: WFST Primary mosaic CCD camera and its first light

Abstract

The Wide Field Survey Telescope (WFST) is a dedicated photometric surveying facility equipped with a 2.5-meter diameter primary mirror, an active optics system, and a mosaic CCD camera with 0.765 gigapixels on the primary focal plane for high quality image capture over a 6.5-square-degree field of view. The mosaic CCD camera is the key device for high precision photometric and high frequency observation and the 'eye' of the telescope for deep survey with wide field. The focal plane consists of three kinds of CCD including scientific imaging sensors, wavefront sensors and guiding sensors. In the scientific imaging area, there are 9 back-illuminated full frame scientific CCDs with pixels of 9K by 9K and pixel size of 10um, which

is mosaicked by 3 by 3 with flatness of 20μm PV. The R&D of the camera including the high precision large-scale mosaicking of detectors, detectors' cryocooling and vacuum sealing, readout and driving with low noise and low power, data acquisition, imaging control, data storage and distribution. In this report, we will present the key technology of the primary camera and its development process and give our test results.

Presenter: Dr. Tony Travouillon
Affiliation: The Australian National University (ANU), Australia
Title: The Wide-Field Spectroscopic Telescope

Abstract

NA

Presenter: Prof. Branden Allen
Affiliation: Institute for Astronomy, University of Hawai'I, USA
Title: Large Detector Planes for Next Generation Observatories

Abstract

I will discuss the activities of the Advanced Detector Development and Engineering Research (ADDER) lab at the University of Hawai'i at Manoa which are focused on the development of technologies for next generation focal planes.

Presenter: Dr. Naidu Bezawada
Affiliation: European Southern Observatory (ESO), Germany
Title: Status of the current and future detectors and detector system needs at ESO

Abstract

The European Southern Observatory (ESO) is more than 60% complete in the construction of a new 39 metre telescope in Chile. The telescope is AO optimized using laser and natural guide stars. The first generation of instruments are well advanced with expected delivery for MICADO and METIS to the telescope in 2029. Both the AO cameras and the instruments use next generation detector systems based on EMCCDs and CMOS detectors for the AO and new large format MCT detectors such as the H4RG-15 devices and the new fully digital Geosnap device for science. ESO has also been very active in baselining the second generation of instruments for delivery in the mid-thirties.

MOSAIC is an optical and NIR versatile multi-object spectrograph that will use the widest possible field-of-view and will be based on either large format CMOS detectors or CCDs for the optical channels as well as large format MCT for the NIR. ANDES is a high resolution optical and NIR spectrograph, again based on similar technology. Some of these detector technologies are described in more detail together with the development of our new detector controller NGCII. This new controller can be interfaced to both fully digital detectors such as Geosnap as well as known detector technologies such as CCDs, HxRG detectors and also the latest APD detectors. A brief outline is given of the status of this controller. For the VLT, ESO has not been idle and the third generation of instruments are reaching maturity but using well-known detector technology, a brief mention is made of these instruments also.

Finally, ESO is looking to the future, further past the delivery of ELT and is working with European industry to see how feasible curved detectors in large numbers. ESO is also working on the future development of many hundreds of large format optical detectors for use in the mid-forties, probably based on CMOS technology, fully digital and curved if possible, the requirements for these detectors is described in further detail.